DOCUMENT RESUME

ED 082 474 EM 011 436

AUTHOR	Abramson, Norman; Ah Mai, Karen
TITLE	Pacific Educational Computer Network Study. Summary of Planning and Review Meeting, January 8, 1973.
INSTITUTION	Hawaii Univ., Honolulu. ALOHA System.
SPONS AGENCY	National Science Foundation, Washington, D.C.
REPORT NO	TR-B-73-3
PUB DATE	May 73
NOTE	10p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Computers; *Computer Science; Conference Reports; *Cooperative Planning; *Economic Factors; Feasibility Studies; International Organizations; *Networks
IDENTIFIERS	Aloha System; Australia; Japan; *Pacific Educational Computer Network; Pacific Region; PECN; United Nationa; United States

ABSTRACT

A summary of the initial planning meeting for the Pacific Educational Computer Network (PECN) is presented. Representatives from the United Nations, Australia, Japan, and the United States met to inquire into the feasibility of the proposed PECN. Topics discussed were the status of computing in the Pacific, the technology of a Pacific network, the economics of such a network, and alternatives in planning a Pacific Educational Computer Network. (Author/PB)

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ED 082474

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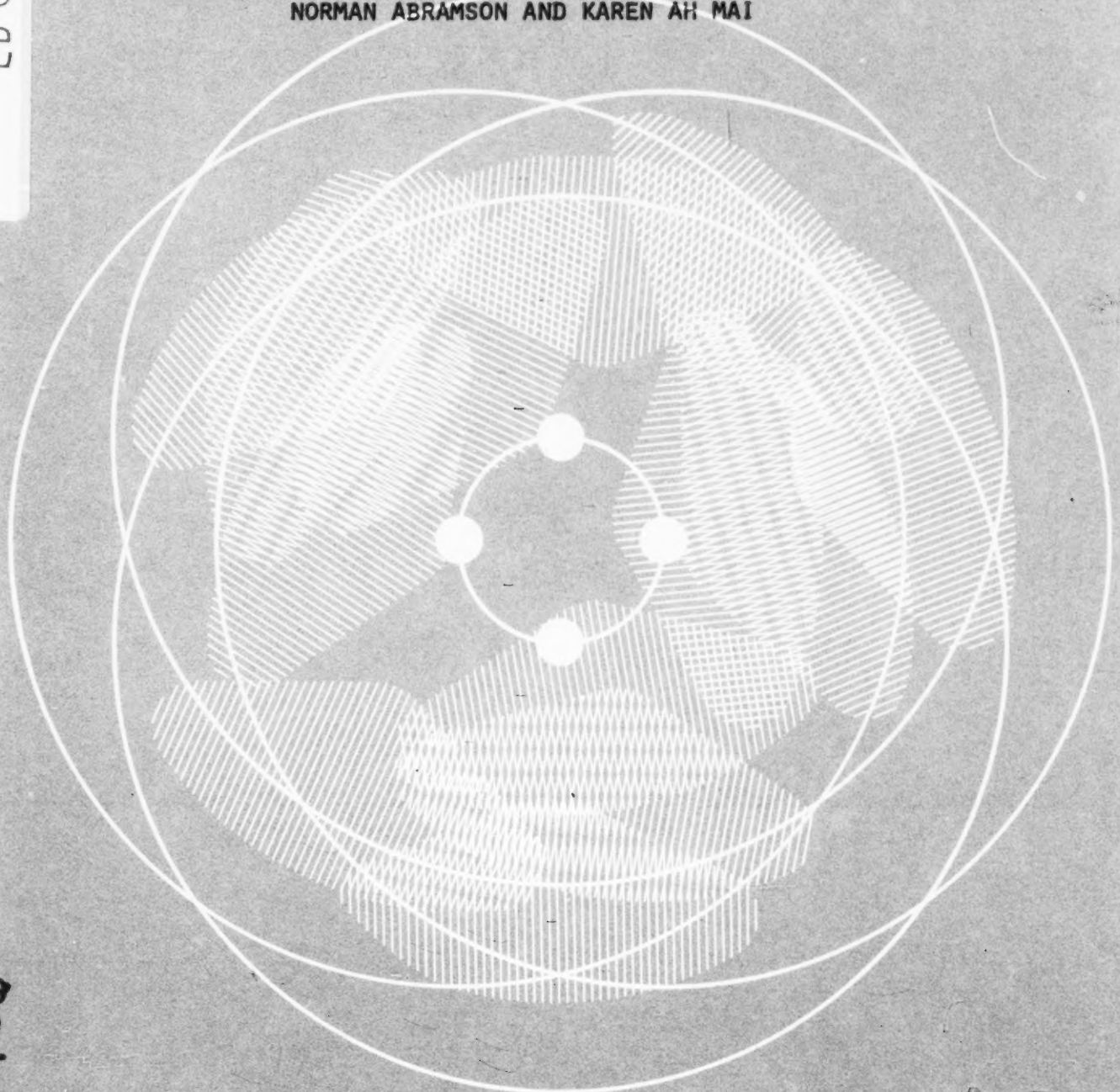
PLANNING AND REVIEW MEETING, JANUARY 8, 1973

BY

NORMAN ABRAMSON AND KAREN AH MAI



EM 011 436

MAY 1973

THE ALOHA SYSTEM

UNIVERSITY OF HAWAII

HONOLULU, HAWAII 96822

TECHNICAL REPORT
B73-3

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U.S. DEPARTMENT OF HEALTH,
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May 1973

This report was supported by the National Science Foundation under NSF Grant No. GJ-33220.

PACIFIC EDUCATIONAL COMPUTER NETWORK STUDY

Planning and Review Meeting, January 8, 1973

INTRODUCTION

The first planning meeting for a Pacific Educational Computer Network was held at the University of Hawaii, Honolulu, Hawaii, on January 8, 1973. Attendees at this meeting were:

1.	Prof. Norman Abramson Technical Director THE ALOHA SYSTEM	University of Hawaii 2540 Dole Street, Holmes 486 Honolulu, Hawaii 96822
2.	Ms. Karen Ah Mai Research Associate THE ALOHA SYSTEM	University of Hawaii 2540 Dole Street, Holmes 486 Honolulu, Hawaii 96822
3.	Mr. Benjamin Barg Chief, New Technologies Office of Science and Technology	United Nations New York, New York 10017
4.	Prof. John Bennett Basser Computing Center	University of Sydney Sydney, N.S.W. 2006, Australia
5.	Prof. John Bystrom Director, PEACESAT	University of Hawaii 2560 Campus Road, Grg 221 Honolulu, Hawaii 96822
6.	Prof. Donald Dunn Dept. of Engineering- Economic Systems	School of Engineering Stanford University Stanford, California 94305
7.	Dr. Eugene Grabbe Director, Dept. of Planning and Economic Development	State of Hawaii 1010 Richards Street Honolulu, Hawaii 96813
8.	Dr. Donald Grace Director, Center for Engineering Research	University of Hawaii 2540 Dole Street, Holmes 240 Honolulu, Hawaii 96822
9.	Prof. Harry D. Huskey Director, Computer Center	University of California at Santa Cruz Santa Cruz, California 95060
10.	Prof. Shoichi Noguchi Research Center for Applied Information Sciences	Tohoku University 1-1 Katahira 2 Sendai Japan
11.	Prof. Juro Oizumi Director, Research Center for Applied Information Sciences	Tohoku University 1-1 Katahira 2 Sendai Japan

Professor Norman Abramson of the University of Hawaii and Professor Juro Oizumi of Tohoku University, Japan, co-directors of the network feasibility study, hosted the meeting.

Topics discussed were the status of computing in the Pacific, the technology of a Pacific network, the economics and technology of such a network, and alternatives in planning a Pacific Educational Computer Network.

STATUS OF COMPUTING IN THE PACIFIC

Reports on the status of computing in the Pacific and Southeast Asia were given by Drs. Oizumi, Bennett, Huskey and Mrs. Ah Mai.

Dr. Huskey reported that computing activity in India was limited to government and industry with little emphasis on education. The governmental computers are concentrated in regional centers. IBM 360/44's are being used in Bangor and Delhi. In addition, Delhi is operating an ICL 1906. In Bombay, a CDC 3600 is being used in a research institute and in Kanpur, an IBM 7044 is being used. The trend is toward the development of these regional centers.

In India the telephone system is already burdened by bad connections and its suitability for data communications is questionable.

Other Southeast Asian computers noted by Dr. Huskey were the Chulalongkorn University NEAC 2200 in Bangkok. Also situated on the Chulalongkorn campus is the Asian Institute of Technology, which operates an IBM 1130. No significant telecommunications capability for computer data currently exists.

Drs. Huskey, Bennett and Abramson provided information on Taiwan. National Chiao Tung University operates an IBM 1620 and has received a $200,000 grant to develop time-sharing. Dr. Abramson recently returned from a trip to Taiwan, and reported the National Taiwan University, Chiao Tung University and the governmental telecommunications laboratory would begin to establish telecommunications links with each other using the methods developed by THE ALOHA SYSTEM at the University of Hawaii. They hope to eventually link up with the University of Hawaii via satellite.

The University of Hong Kong uses an ICL 1904. No other data was available.

A general conclusion of the area covered so far was that funds were being allocated for hardware but there was difficulty in acquiring supporting software. The concept of a resource-sharing network which could make available hardware, software, and data to these smaller users was thought to be an ideal solution to the problem of limited funds.

Dr. Oizumi reported on educational computing and networking activities in Japan. Japan will begin the feasibility study of a Japan National Computer Network in April, 1973. In three to five years, they hope to complete interconnection of the network.

At the present there are 72 colleges and universities in Japan. There are seven major universities which serve as regional computation centers to these smaller institutions. They are linked by dedicated lines, primarily at 50 bps. 1200 bps lines are also used.

The computing equipment at these regional centers appear to be the most sophisticated in Asia. The largest installation is at Tokyo University, which has a HITAC 8800 and a HITAC 8700, each with 2 CPU's. There is also a 3 MB core memory.

Tohoku University has a dual processor NEAC 2200/700 and a NEAC 2200/500 and supports the computing requirements of seven smaller universities and colleges in the region. Other regional centers are located at Hokkaido University, Nagoya University, Osaka University, Kyoto University, and Kyushu University.

The Japanese effort is the most centralized government-supported educationally oriented network reported in the Pacific Educational Computer Network Study so far. All telecommunications for the Japanese network are provided by Nippon Telephone and Telegraph. No satellite communications for general use within Japan is foreseen in the near future. Currently, Tohoku University and the University of Electrocommunications in Tokyo are planning to interface into the network formed by NASA Ames Research Center, the University of Alaska, and THE ALOHA SYSTEM via ATS-1.

Dr. Bennett reported on computing in the South Pacific. He commented that PEACESAT, a non-computer telecommunications project directed by Dr. John Bystrom at the University of Hawaii, appears to have laid good groundwork for other projects of a similar nature. Of particular interest were the inexpensive ground stations developed by the PEACESAT project for voice communications. Ground stations for voice and facsimile transmission already exist in Wellington, New Zealand; Lae, New Guinea; and Suva, Fiji. Linkage with the University of Hawaii is established through the ATS-1 satellite.

Computing capacity in the islands of the South Pacific include IBM 360/30's in New Caledonia, an ICL 1962 at TPNG, a NOVA at Lae, New Guinea, a 1902A at Suva, Fiji, a government service bureau, and an IBM System 3 for the government of American Samoa. There is interest in using computer-aided instruction in secondary education in Suva and health systems processing

at the University of the South Pacific. Most of the students at Lae are using the computer.

Educational computing in Australia is rather extensive. There are 14 universities, with computing equipment ranging from PDP-10's as the primary computer to DCD CYBER 72's. Networking is not substantial.

Communications in Australia is controlled by the Post Office. The data network is not used extensively yet. Satellite transmission is expected by the end of the decade. The current communications network is based on a colonial structure with emphasis on transmission to Europe and back but not necessarily among the regions in Australia.

Preliminary results from the questionnaires sent to possible participants of the network were presented by Mrs. Ah Mai. The analysis of data was based upon (1) current resources, which would be indicative of the current capability to develop a network; and (2) the current level of computing service provided by the responding institutions. The results were derived from about a 60% sample of institutions queried. (Note: Since that time this figure has increased to about 75%.)

In analyzing the current resources, it was found that 17 large, 2 medium, and 7 small computers served as the primary computing equipment of their institutions. Large computers were defined as having a purchase price of $US 1 million or more; medium computers, $US 250,000 to $US 1 million; and small, $US 10,000 to $US 250,000. This breakdown suggests that there are 17 large computers which could potentially serve as resource computers for other terminal users in the network.

The types of primary computers, that is, the main computer of the institution used were predominantly IBM, followed by CDC, Fujitsu, and Facom. The size varied widely, however, and of the 28 respondents, no more than 3 respondents had similar equipment.

Even though there was not a substantial amount of hardware compatibility, every institution used FORTRAN as a major language. This indicates that inter-installation programming compatibility is at least possible. Other major languages in heavy use among the respondents were COBOL, ALGOL, and PL/1.

Two-thirds of the respondents had telecommunications capability. Sixteen were transmitting at 1200 bps or less; 11 at 1201-9600 bps; and 3 at 9600+ bps.

At the present time among the respondent universities, there are 53,850 computer users. Of these, 31,898 are students who are taking computing

courses. Other users are faculty and researchers. This would represent the minimum load that a network in the Southeast Asia and Pacific Rim would have to support.

TECHNOLOGY OF A PACIFIC EDUCATIONAL COMPUTER NETWORK

Dr. Abramson reported on two satellite data communication channels now in operation in THE ALOHA SYSTEM at the University of Hawaii.

Because of the geographic isolation of Hawaii, one of the original objectives of THE ALOHA SYSTEM project was to study the feasibility of computer communications by means of satellite. With the development of digital communication systems by COMSAT in which data at the rate of 50 kilobits can be transmitted through a single voice channel, data transmission by satellite has become both technologically and economically feasible.

There is a basic and important difference between the use of a satellite channel and a wire channel for data communications. The satellite channel is a broadcast channel as opposed to a point-to-point wire channel. Thus a single voice channel, say between ground stations A and B, can be used in broadcast mode among any set of ground stations, providing a full broadcast capability of two 50 kilobit channels. Thus a single commercial satellite voice channel could be employed with the following characteristics: (1) The single voice channel could provide two up-link and two down-link 50 kilobit data channels. (2) Each of these four channels could be simultaneously available to any COMSAT ground station in sight of the satellite. During the past year THE ALOHA SYSTEM has initiated two specific research projects for satellite extension of THE ALOHA SYSTEM and several theoretical studies involving the unique properties of satellite channels. The first of the projects involves the use of large commercial ground stations and the establishment of an ARPANET SATELLITE SYSTEM; the second involves the use of small inexpensive ground stations in a joint research effort with NASA/AMES. In December 1972, a digital communication subsystem was installed between the COMSAT ground stations at Paumalu, Hawaii, and Jamesburg, California. The first subscriber of this service was THE ALOHA SYSTEM, which, with its newly installed TIP, became the first operational satellite node on the ARPANET.

The ARPANET consists of about thirty major machines at universities and research centers on the U.S. mainland linked by 50 kilobit land lines and (in the case of THE ALOHA SYSTEM) a single 50 kilobit satellite channel.

The COMSAT channel used to connect THE ALOHA SYSTEM to the ARPANET is a relatively expensive method of connecting two nodes in a computer network. The lease cost of the channel, including ground links is about $10,000/month, and although this cost can be expected to decrease in the future, such costs do not appear feasible for a large Pacific network. As pointed out above however, a single channel of this type could be used to connect any set of ground stations in the Pacific. Thus, there is at present no technological reason why this single full-duplex 50 kilobit channel could be used by any earth station which can see INTELSAT IV. The regulatory barriers to such a use are now under investigation.

The second satellite project in THE ALOHA SYSTEM involves the use of the NASA satellite ATS-1 using small, inexpensive ground stations, which cost less than $5,000 each. Thus far we have progressed to the point where a random access burst mode data channel is in operation between the University of Hawaii and NASA/AMES Research Center in California. In 1973 this network will be joined by the University of Alaska. During the following year we plan to interface this channel into computers near each of these ground stations, extend the number of ground stations to other sites, including possibly universities in Japan and Taiwan and establish a small ground station satellite network on an experimental basis.

ALTERNATIVES IN PLANNING A PACIFIC EDUCATIONAL COMPUTER NETWORK

Mr. Barg of the United Nations proposed that one method of implementing at least the first steps of such a proposal would be for the more advanced nations, that is, Japan, Australia, New Zealand, Canada, the USSR and the United States, to establish bilateral or multilateral projects with specific underdeveloped nations or with each other for pilot studies in international telecommunications development. He emphasized that a sequence of <u>bilateral</u> agreements in the field of computer network organization results in the automatic establishment of a <u>multilateral</u> agreement, as long as one or more nodes participate in several of the bilateral links. Thus if links were set up, say, from Japan to Hawaii and from Australia to Hawaii it would immediately be possible to transfer

data from Japan to Hawaii to Australia and then with a minor change, directly from Japan to Australia. In addition, since Hawaii is now a node in the ARPANET, each bilateral agreement for a link to Hawaii would result in a new link to the ARPANET.

Dr. Grabbe emphasized the importance of planning meetings of this sort to the establishment of a Pacific Educational Computer Network and suggested the establishment of some continuing mechanism to ensure the flow of information to and from possible participating nations. The formation of such a mechanism was encouraged by others at the meeting and a follow-up meeting was tentatively scheduled for January 1974, in conjunction with the special subconference on Computer Communication Networks to be held at the Seventh Hawaii International Conference on Systems Sciences (HICSS-7).